Journal of Animal Research: v.11 n.1, p. 217-221. February 2021

DOI: 10.30954/2277-940X.01.2021.29

SHORT COMMUNICATION

Ecology of Gastrointestinal Parasites Interactions in Wild Gaur (*Bos gaurus*)

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Received: 28 Aug., 2020 **Revised:** 04 Jan., 2021 **Accepted:** 29 Jan., 2021

ABSTRACT

The Gaur (*Bos gaurus*), or the Indian bison, is native to South and Southeast Asia and has been listed as Vulnerable on the IUCN Red List since 1986. Diseases manifestation may reduce the body potentials leading to morbidity and mortality. Little is known about the health parameters and gastrointestinal parasites infection in free-ranging gaurs as well as other wild animals. A detailed study was conducted to know the epidemiology and prevalence of gastrointestinal parasites in wild Gaur (*Bos gaurus*) at Satpura Tiger Reserve, Madhya Pradesh, India. A total of 90 fecal samples from wild Gaur were collected from the grazing area of the tiger reserve. Detailed coprological examination for the presence of parasitic eggs/oocysts by direct smear examination, standard sedimentation, and floatation techniques was performed. Out of the 90 fecal samples of wild Gaur, 41.11% were found positive for single or mixed parasitic infection. The overall prevalence rate of Strongyles was maximum 13 (14.44%) followed by that of *Eimeria* sp. 11 (12.22%), *Moniezia* sp. 10 (11.11%), Amphistomes 6 (6.66%), *Trichuris* sp. 5 (5.55%), and *Fasciola* sp. 3 (3.33%). Wild gaurs at Satpura Tiger Reserve were exposed to parasites having pathogenic significance.

HIGHLIGHTS

- The study showed varying degree gastrointestinal parasites interaction in free Wild Gaur (*Bos gaurus*).
- Fecal samples of wild Gaur, 41.11% were found positive for single or mixed type of parasitic infection.

Keywords: Wild gaur, Satpuda Tiger Reserve, gastrointestinal parasites

The Gaur (*Bos gaurus*), or the Indian bison, is native to South and Southeast Asia and has been listed as Vulnerable on the IUCN Red List since 1986. The global population has been estimated at a maximum of 21,000 mature individuals until 2016. It declined by more than 70% during the last three generations and is extinct in Sri Lanka and probably in Bangladesh. However, in well-protected areas, it is stable and increasing (Duckworth *et al*., 2016). The wild ruminants are natural food recourses for wild carnivores; however, the sustenance of wild ruminants in protected and nonprotected habitat depends upon their agility and alertness (Kiziewicz, 2013). Diseases manifestation may reduce the body potentials leading to morbidity and mortality. Little is known about the health parameters and gastrointestinal parasites infection in free-ranging gaurs as well as other wild animals. Parasites play a major role in the lives of animals, with effects ranging from negative impacts on host population size to the evolution of host behaviors to combat parasites. In a few examples, studies have shown that parasites regulate population sizes and may be responsible for extinction (near extinction) of some host species (Lindenfors *et al*., 2007). Systematic investigation of parasitic diseases of wildlife is still in its infancy in India, and data are still on the baseline. The parasitic burden may negatively influence the health status of the animals (Hoberg *et al*., 2001).

How to cite this article: Bhaydiya, N., Rokde, A., Singh, K.P., Sharma, V., Sharma, G. and Kumar, S. (2021). Ecology of gastrointestinal parasites interactions in wild Gaur (*Bos gaurus*). *J. Anim. Res.,* **11**(1): 217-221.

Source of Support: None; **Conflict of Interest:** None

Parasitic diseases constitute one of the major problems causing even mortality in wild animals, the effects of which range from sub-clinical disease to death. Parasites cause a multitude type of problems for wildlife animals, and although it often appears that wildlife has adapted to the presence of different parasites, but wild animal has not adapted to the adverse effects of parasitism (Opara *et al*., 2010). Parasites can affect health and reproduction directly through pathological effects (blood loss, tissue damage, spontaneous abortion, behavioral changes, congenital malformations, and death) and indirectly by reducing the host's immunity and affecting the physical condition (Thawait *et al*., 2014).

With the advancement of agriculture and livestock/ animal husbandry practices into natural areas, humans and their domestic animals have regularly been coming into greater contact with wild animals in their habitats. This type of closer contact facilitates the spread of infectious agents and parasites to new hosts and environments, leading to establishing new relationships between hosts and parasites and new ecological niches in the disease transmission chain (Correa and Passos, 2001). Pathogen maintenance within wildlife populations and spill-over to livestock has been reported as a precursor to disease emergence in the humans population (Morse *et al*., 2012 and Jones *et al*., 2008). Diseases have been documented as a major cause of local extirpation of a number of wild animal species in India. Until and unless the different epizootiological cycle of various parasitic infections is delineated, and it is difficult to plan out measures to eradicate these diseases from free-living wild animals (Sengar *et al*., 2017).

After poaching and habitat destruction, diseases are the most important factor in a population reduction of wildlife. Diseases may affect various species in different ways, can affect the whole ecosystem leading to changing ecology, biodiversity, behavior, niche or composition of heard populations, and even led to the extinction of some species. Literature showed in the protected area, wild herbivores exposed to parasites, including some that are known to be pathogenic, and GI parasitic prevalence is an important parameter to monitor the health of free-ranging wild Gaur and other herbivores.

This work was conducted at the Satpura tiger reserve, located in Hosangabad and Betul districts of Madhya Pradesh on free-ranging wild herbivores. It lies between latitude 22'19'' to 22'45''and longitude 77'53'' to 78'34''. Satpura Tiger Reserve comprises of three protected areas; namely, Satpura National Park (528.73 sq.km), Bori Sanctuary (485.71 sq.km) and Pachmarhi Sanctuary (491.63 sq.km) and a peripheral buffer area of 794.04 sq.km comprising of areas of Hoshangabad division, The terrain of the national park is extremely rugged and consists of fascinating deep valleys, sandstone peaks, narrow gorges, rivulets, waterfalls, thickly dense green forest of Sal and other medicinal herbs. The native fauna includes semi-captive elephant, tiger, leopards, wild dogs, wolves, chital, sambhar, nilgai, four-horned antelope, blackbuck, chinkara, barking deer, rhesus macaque, common languor, giant flying squirrel, gharial, sloth bears, hyena, wild boar, jackal, hare, porcupine, mongoose, and pangolin.

A total of 90 fecal samples from wild Gaur were collected from the grassland and adjoining area of the tiger reserve. About 25 g of freshly voided fecal sample of each animal were collected in an individually labeled polythene bag, and these samples were properly sealed, labeled with the date, time, and place, brought to the School of Wildlife Forensic and Health Laboratory for detailed coprological examination for the presence of parasitic eggs/oocysts by direct smear examination, standard sedimentation by Baermann test and floatation techniques by Shatter sugar method described by Soulsby 1982 and Sloss *et al*., 1994. For smooth working, the parking area was divided into three different zones A, B, and C, as per the topography for the collection of samples.

Out of the 90 fecal samples of wild Gaur, 41.11% were found positive for single or mixed parasitic infection (Table 1). In a study conducted at Nandan Van Zoo Raipur, Chhattisgarh by Thawait *et al*. (2014) observed a 46.2% prevalence of GI parasites in captive wild animals. The overall prevalence rate of Strongyles was maximum 13 (14.44%) followed by that of *Eimeria* sp. 11 (12.22%), *Moniezia* sp. 10 (11.11%), Amphistomes 6 (6.66%), *Trichuris* sp. 5 (5.55%), and *Fasciola* sp. 3 (3.33%). The results of present investigation revealed that the Strongyles were found to the most prevalent parasites. Similar findings were also observed by Mir *et al*. (2016) and concluded this could be possible due to a more convenient environment for the development of the preparasites stages in the hot-humid environmental condition of the region. The overall maximum prevalence rate of parasitic infection in the free-ranging Gaur was 50% in rainy season and minimum

Table 1: Seasonal prevalence (%) of parasitic infection in free ranging herbivores

Season	Number examined	Number infected	Percentage infection	Strongyles (%)	*Strongyloides* (%)	*Trichuris* (%)	Amphistomes (%)	*Coccidia* (%)	*Moniezia* (%)	*Fasciola* (%)
Winter	30	14	46.6	5(16.6)	0	2(6.66)	2(6.66)	3(10)	2(6.66)	1(3.33)
Summer	30	08	26.6	1(3.33)	1(3.33)	1(3.33)	2(6.66)	3(10)	2(6.66)	0
Rainy	30	15	50	7(23.33)	2(6.66)	2(6.66)	2(6.66)	5(16.66)	6(20)	2(6.66)
Total	**90**	**37**	**41.11**	**13(14.44)**	**3(3.33)**	**5(5.55)**	**6(6.66)**	**11(12.22)**	**10(11.11)**	**3(3.33)**

26.6% in summer season, whereas in winter it was 46.6%. Prevalence of Strongyles was the highest during the rainy season (23.33%) followed by winter season (16.6%) and least during summer seasons (3.33%); *Strongyloides* sp. showed maximum prevalence during the rainy season (6.66%) followed by summer (3.33%), and no infection was observed during winter seasons, and the prevalence of Amphistomes are equal (6.6%) during winter, rainy, and summer seasons, *Eimeria* sp. showed highest (16.66%) prevalence during the rainy season and equal prevalence during winter and summer seasons (10%), *Moniezia* sp. showed highest (20%) during the rainy season and equal prevalence during winter and summer seasons, *Fasciola* sp. showed highest (6.66%) during the rainy season followed by winter season (3.33%), and no infection was observed during the summer season. Singh *et al*. (2019) also reported a prevalence rate of *Fasciola* (25%) in Gaur in a limited number of samples, which was much higher than the present study. The prevalence of parasitic infection was highest in Zone B (58.33%), followed by Zone A (56.66%) and least in Zone C (40%). The maximum prevalence rate of *Moniezia* sp. (16.66%) and *Eimeria* sp. (16.66%) in Zone B, Strongyles (8.33%) in Zone B, *Strongyloides* sp. maximum (6.66%) in Zone A, *Trichuris* sp. highest (15%) in Zone C, Amphistomes (10%) in both Zone A and Zone C, *Fasciola* sp. (5%) in Zone C. The overall mean EPG of Strongyles was 166.6±23.57 in Gaur. The EPG of Strongyles in Gaur mean EPG was highest in Zone C during the winter season. The overall mean EPG of *Strongyloides* sp. was 66.6±23.57 in Gaur. The EPG of *Strongyloides* sp. was highest. The mean EPG was highest in Zone B, followed by Zone A in winter and rainy seasons, and least in zone C during summer. The overall mean EPG of *Trichuris* sp. was 177.7±13.61 in Gaur and highest in all three zones during the rainy season. The overall mean EPG of Amphistomes was 111.1±13.60 in Gaur and EPG of Amphistomes highest in all three zones during the rainy season. The overall mean EPG of Coccidia was 166.6±23.57 in Gaur and highest in Zone B during winter and rainy season. The overall mean EPG of *Moniezia* sp. was 88.8±27.21 in Gaur and highest in Zone C during the rainy season. Animals with a larger home range size come into contact with more parasites, leading to increased parasite species richness, and it is likely to lead to increased risk of infection. Thus, we predict that parasite diversity in large herbivores hosts increases with home range size, contamination of pasture with parasites, sharing of grazing land with livestock, type of water bodies, day range length and peak feeding hours, etc.

Interference with ecosystem such as deforestation, construction of roads, buildings, check dams, agriculture, the formation of ecological mosaics, tourism, etc., changed the diurnal habits of wild Gaur in to nocturnal. Gaur herd remain together during the dry summer season and then dispersing into the hills with the arrival of the monsoon. They frequently go into fields and graze alongside domestic cattle in Nilgiri Hills. Trematodes, cestodes, nematodes, eggs, and protozoal oocysts were found in the survey both in wild Gaur as well as in domestic cattle under the common ecosystem (Allwin *et al*., 2016). Studies from Nilgiri Hills southern part of India suggested that the prevalence of GI parasites in wild animals might be due to lack of health care, diversified feeding behavior, dispersing of wild animals from the core zone of the wildlife environment into the buffer zones or ecological interfaces, where co-existing of Gaur, Nilgiri tahr, sambar deer, spotted deer, wild pigs and with other livestock (Allwin *et al.,* 2015). Allawin *et al*. (2015) noticed the parasitic prevalence was 63.3% and 80.0% in wild Gaur and domestic cattle, respectively, with an overall prevalence of 70.0%. The helminthic parasites observed were trematodes (13.3%) include *Fasciola* sp. (3.3%), Amphistome (6.7%) and *Schistosoma* sp. (3.3%), cestodes (20.0%) include *Moniezia* sp. (20.0%), and nematodes (43.3%) include *Toxocara*

sp. (6.7%), Strongyle (23.3%), *Oesophagostomum* sp. (3.3%), *Trichuris* sp. (6.7%), *Mecistocirrus* sp. (3.3%) and unsporulated *Coccidia oocysts* (13.3%) in Wild Gaur. Chakraborty and Islam (1996) performed a survey in wild herbivores at Kaziranga National Park and recovered the eggs of strongyles, *Strongyloides* sp. *Toxocara* sp., *Paramphistomum*, *Fasciola,* and oocyst of coccidian. . Allawin *et al.* (2016) found higher parasitic loads in wild herbivores, including Gaur, during the southwest monsoon than summer season and concluded increased pasture contamination and parasitic burden in the rainy season had increased survival of larvae and increased population of intermediate host.

The high prevalence of parasites encountered may be due to the existence of favorable climatic conditions, which support prolonged survival of infective nematode larvae on pasture. Moderate temperature, moisture, and more humidity between the soil and the herbage are favorable to the survival of eggs and free-living stages of parasites. Opara *et al*. (2010) reported a high overall prevalence of 76.6% of Gastrointestinal Parasitism in Captive Animals at the Zoological Garden, Nekede Owerri, Southeast Nigeria, and concluded temperature & humidity of the area are suitable for the development of endoparasites. The higher rate of prevalence during the rainy season is due to the suitable macro and microclimate for the survival and propagation of free-living eggs, larval stages, oocyst of parasites, and intermediate hosts at several places. The parasitic ova, cysts, snails, and other intermediate hosts get a favorable humid sub-tropic climate for development in the plain grasslands, grazing areas with temporary stagnated water. The animals grazing around the periphery of these areas can naturally acquire more infection (Voyles *et al*., 2015). However, low-grade infections can propagate and develop the disease, hence could not be neglected. Most of the animals observed did not show any obvious clinical signs, suggesting that low to moderate infection at the subclinical level may be present in these animals. This shows that an undetermined number of wild animals may be parasitized without even showing outward or overt physiological signs of infection (Opara *et al.*, 2010).

Comparative assessment of gastrointestinal parasites in free-ranging ruminants is helpful in the formulation of a preventive strategy to overcome the disease burden but also useful in maintaining a healthy population of wild herbivores in forests.

CONCLUSION

It is concluded that a parasitic prevalence survey is vital in monitoring the impact on the health and maintenance of the Wild gaur population and the prevalence rate of GI parasites in the wild Gaur. The intensity of infection by GI nematodes also varies from no to moderate infestation. Management of diseases is an important component to wildlife disease control and management, considering that most of the wild animal species are already threatened due to habitat fragmentation and loss, diminished genetic diversity, overexploitation of herbivores themselves, or their predators, environmental pollution, poaching, and persecution by humans. Wild gaurs were exposed to parasites, including some that are known to be pathogenic. Parasitic prevalence is an important parameter to monitor the health of free-ranging wild Gaur. Future studies are required to evaluate the impact of GI parasites in the study area.

ACKNOWLEDGEMENTS

Authors are thankful to the Satpuda Tiger Reserve management and Nanaji Deshmukh Veterinary Science University for providing all the facilities to conduct the research work.

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